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Collapsed scrums and collision tackles: what is the injury risk?

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ABSTRACT

Aim To establish the propensity for specific contact events to cause injury in rugby union. **Methods** Medical staff at participating English community level rugby clubs reported any injury resulting in absence for one match or more from the day of the injury during the 2009/10 (n=46), 2010/11 (n=67), and 2011/12 (n=76) seasons. Injury severity was defined as the number of matches missed. Thirty community rugby matches were filmed and the number of contact events (tackles, collision tackles, rucks, mauls, lineouts and scrums) recorded. **Results** Of 370 (95% CI; 364-378) contact events per match, 141 (137-145) were tackles, 115 (111-119) were rucks and 32 (30-33) were scrums. Tackles resulted in the greatest propensity for injury [2.3 (2.2-2.4) injuries/1000 events] and the greatest severity [16 (15-17) weeks missed/1000 events]. Collision tackles (illegal tackles involving a shoulder charge) had a propensity for injury of 15.0 (12.4-18.3) injuries/1000 events and severity was 92 (75-112) weeks missed/1000 events, which were both higher than any other event. Additional scrum analysis showed that only 5% of all scrums collapsed, but the propensity for injury was four times higher [2.9 (1.5-5.4) injuries/1000 events] and the severity was six times greater [22 (12-42) weeks missed/1000 events] than for non-collapsed scrums. **Conclusions** Injury prevention in the tackle should focus on technique with strict enforcement of existing laws for illegal collision tackles. The scrum is a relatively controllable event and further attempts should be made to reduce the frequency of scrum collapse.

INTRODUCTION

Rugby union is characterised by periods of low intensity exercise, punctuated by high intensity activity including physical confrontation between opposing players (1-3). Most injuries are associated with these contact events (4-6), and they account for 80% of all injuries in English community rugby (7). The tackle, ruck and scrum are of particular interest, associated with 50%, 9% and 4% of all injuries, respectively (7).

The incidence of injuries (per 1000 player hours) sustained in specific contact events has been described (4-8). However, in order to determine the risk of injury per contact event (the 'propensity' for injury), the frequency of contact events is needed (regardless of whether they result in injury). To date, analysis of match events is largely limited to the international and elite game with no published information pertaining to the frequency of contact events during English community rugby. However, given the differing training and skill status between the elite and community levels, it cannot be assumed that match analysis from elite level rugby can be applied to the community game.

Propensity for contact events to cause injury has been described for elite English rugby (9), with the tackle identified as the most frequently occurring contact event, the event causing the most injuries, and the event causing the greatest number of days lost through injury. However, the greatest propensity for injury was for collision tackles and scrums. From an injury prevention perspective, these findings suggest that the tackle deserves attention because of its frequency, but also that specific attention should be focused on collision tackles and scrums which occur less frequently but have a higher risk per event. The propensity for specific events to cause injury is not known in community level rugby, which represents the overwhelming majority of senior players. Differing physical and skill attributes of professional full time players compared with part-time semi-professional and amateur players are likely to impact upon the physical demands of the specific contact events and subsequently injury frequency, type and severity at the different levels of match play. Therefore, the aim of this study was to determine the propensity of specific contact events to cause injury in community level rugby.

METHODS

Study Design

We combined injury data (using a prospective cohort design) with match analysis data. Senior male first team squads at English community-level clubs participating in the Rugby Football Union (RFU) league levels 3-9 were invited to participate in the study, which was conducted over three seasons (2009/10, n=46; 2010/11, n=67; 2012/12, n=76 clubs). Having been provided with information about the study, individual players could opt-out by informing club medical staff. Permission for video footage to be recorded and analysed was obtained from all clubs involved in the selected matches. Clubs were classified as group A (RFU levels 3 and 4; highest level of English community rugby with many semi-professional players), B (levels 5 and 6; mainly amateur clubs) and C (levels 7, 8 and 9; mainly recreational and social clubs). The study had Institutional Ethics approval.

Match Analysis

Footage from 30 community rugby matches was analysed, with 10 matches from each group. Matches were filmed from an elevated position using one video camera (Sony DCR-TRV900E, Japan) mounted on a tripod. The ball was kept in the centre of the view with an approximate radius of 10 m. Match footage was captured to analysis software (SportsCode Pro 7.0.150, Sportstec, Australia). Every contact event (tackle: tackler stops the progress of the ball carrier with the use of his arms; (illegal) collision tackle: tackler stops the progress of the ball carrier without the use of his arms; ruck: one or more players from each team contesting the ball on the ground; maul: ball carrier in contact with at least two other players on their feet; lineout: a minimum of two players from each team contesting a ball thrown in by one team to re-start play and scrum: eight players from each team pushing against each other in a crouched position and contesting the ball fed in by one team to re-start play) was identified and recorded.

Time-loss injuries

Medical staff at participating clubs completed and returned injury forms. Any injury incurred during a first team match resulting in an absence from participation in match play for one week or more from the day of the injury was defined as a “time-loss” injury. The date of return to match play was recorded as the return to play date and injury severity was defined by the number of weeks missed. Therefore, the least severe injuries are ‘moderate’ (8-28 days absence) according to the IRB consensus statement for injury definitions (10).

For all time-loss injuries, details about the injury were recorded including injury event, severity (number of matches missed through injury) and type (body location, anatomical structure) using a standard report form. Details on the type of injury were recorded using the Orchard Sports Injury Classification System, version 8 (11). Only injuries incurred during match play at the participating clubs were recorded and therefore absences from match play due to illness or injuries sustained through any other activity (including rugby training) were not included.

Data Analysis

Injury incidence was recorded as the number of injuries/1000 player hours of match exposure and 95% confidence intervals (CI) were calculated. Player hours of match exposure was calculated by the number of matches x number of players per team x match duration (hours). Propensity of a contact event to cause injury was calculated as the number of injuries per 1000 contact events. For propensity, the number of injuries was multiplied by 1.92 to account for the fact that two teams were always exposed to injury from the contact events, but on most occasions only one team was under injury surveillance. The number of weeks missed per 1000 player hours was calculated as injury incidence x mean severity. Weeks missed per 1000 events was calculated by the number of injuries per 1000 events x mean severity for that contact event. Differences between groups were determined using a two-tailed Z test for comparison of rates (12). Differences were deemed to be statistically significant if $P \leq 0.05$.

RESULTS

Contact events

For all groups combined, there were 370 contact events per match (95% CI 364 to 378) with more in Group A matches (399 events per match; 95% CI 387 to 412) compared with Group B (374 events; 95% CI 362 to 386) and Group C (339 events; 95% CI 328 to 350, both $P < 0.05$) and more in Group B than C ($P < 0.01$). The same differences were found between groups for the frequency of tackle, ruck and collision tackle events (All $P < 0.05$) and there were more mauls in group B compared with Groups A and C (both $P < 0.05$). The number of scrums and lineouts per match were not different between groups.

Injury incidence

A total of 1104 time-loss injuries associated with contact events were reported over 4635 matches. For Groups A, B and C, there were 365, 384 and 355 injuries over 1130, 1730 and 1175 matches, respectively. The injury incidence for Group A (17.4 injuries/1000 hours; 95% CI 15.8 to 19.2) was greater than groups B (12.7 injuries/1000 hours; 95% CI 11.6 to 13.9) and C (11.1 injuries/1000 hours; 95% CI 10.1 to 12.3; $P < 0.05$) as reported previously (7).

Injury risk per event

For all groups combined, propensity for injury was greatest for collision tackles (Table 1), at 15.0 injuries per 1000 collisions tackles. There was a significantly greater risk of injury per tackle compared with all other contact events (apart from collision tackles) and risk was greater to the player being tackled than the tackling player ($P < 0.001$) (Table 1). There were significantly more injuries per 1000 events for all contact events combined in group A matches (1.5 injuries per 1000 events; 95% CI 1.4 to 1.6) than groups B (1.1 injuries per 1000 events; 95% CI 1.1 to 1.2) and C (1.2 injuries per 1000 events 95% CI 1.1 to 1.3) (both $P < 0.001$). Similarly there was a greater risk of tackle injuries in group A (2.8 injuries per 1000 tackle events; 95% CI 2.6 to 3.1) than groups B (2.1 injuries per 1000 tackle events; 95% CI 2.0 to 2.3) and C (2.1 injuries per 1000 tackle events; 95% CI 1.9 to 2.3). There were significantly fewer collision tackle injuries per 1000 events for group A clubs (7.3 injuries per 1000 events; 95% CI 4.9 to 10.9) compared with B (34.9 injuries per 1000 events; 95% CI 25.8 to 47.2) and C (26.3 injuries per 1000 events; 95% CI 18.6 to 37.0). No differences were found between groups A, B and C for the number of injuries per 1000 mauls, rucks, scrums, and lineouts.

Table 1: near here

Injury severity

More weeks were missed per 1000 hours due to injuries in the tackle compared with all other events, with a higher rate for the tackled compared with the tackling player (Table 2). There was a higher incidence of weeks missed per 1000 player hours in Group A (105; 95% CI 95.0 to 116.7) compared with B (79.5; 95% CI 72.0 to 87.9) and C (64.6; 95% CI 58.3 to 71.7) (both $P < 0.05$). More weeks were missed per 1000 collision 'tackle' events compared with all other contact events while the (legal) tackle event was responsible for the second most weeks missed per 1000 events (Table 2).

Table 2: near here

A total of 965 scrums were identified over 30 matches (32 scrums per match) of which 54 (6%) were collapsed scrums. The percentage of collapsed scrums was similar in groups A (6%), B (6%) and C (5%). Only data from the 2011/12 season is included in the scrum analysis, as this was the only season in which collapsed scrums were included as an option for injury event in time-loss injury recording. There was a significantly higher propensity for injury and there were significantly more weeks missed per 1000 events for collapsed scrums compared with scrums that did not collapse (Tables 3 & 4).

Table 3: near here

Table 4: near here

For all contact events combined there was a significantly higher incidence of contact injuries to the lower limb region (5.0; 95% CI 4.6 to 5.5) compared with the head/neck (2.1; 95% CI 1.8 to 2.4), trunk (0.9; 95% CI 0.8 to 1.2) and upper limbs (3.7; 95% CI 3.3 to 4.1) (all $P < 0.001$). For the ruck, maul, lineout, scrum and being tackled, the lower limb was the most common injury site, while the upper limb was the most common site for tackling injuries. For tackle injuries, there was a higher incidence of upper limb injuries to the tackler compared with the tackled player ($P < 0.001$; Figure 1) and a higher incidence of lower limb and trunk injuries to the tackled player (both $P < 0.001$).

Figure 1: near here

DISCUSSION

In community rugby union tackles have the highest injury incidence and the second highest risk of injury per event, but illegal collision tackles pose the greatest risk of injury per contact event. Scrums present a risk per event of similar magnitude to rucks, mauls and lineouts; however, collapsed scrums present a particular risk, with considerably higher propensity for injury and severity per event when compared with scrums that do not collapse.

The tackle is the most common contact event in community rugby and the contact event with the highest injury incidence and matches missed per 1000 player hours. Incidence and matches missed expressed per 1000 events are also higher for the tackle than any other event apart from collision tackles. These findings are consistent with the fact that tackles occur in open play, often involve relatively high velocity impacts, and in many cases the tackler and ball carrier have limited time to prepare for the contact situation compared with other events. Injury risk was higher when being tackled compared with tackling and it has been demonstrated that most tackle injuries to the ball carrier are sustained when the tackler approaches from the ball carrier's peripheral vision (13) or from behind (13, 14), although we were not able to collect this information in this study. There was a significantly higher incidence of injury to the upper limb in players making a tackle compared with the ball carrier and a higher incidence of lower limb and trunk injuries in the ball carrier. This finding supports previous assertions that lower limb injuries to the ball carrier may be a consequence of the additional load placed on this region by the weight of the tackler (14, 15), whereas the tackler is likely to lead into the tackle with the upper limb, possibly making contact with the moving lower limb of the ball carrier (15). Unfortunately, we do not have information from either match analysis or injury data relating to the frequency of tackles involving more than one tackler, and are therefore unable to comment on the relative risk of this type of tackle to either the ball carrier or the tacklers. However, our data support continued efforts to improve tackle safety; this is likely to be primarily through the development of correct technique.

Collision tackles (shoulder charges) are illegal in rugby union and we found that these carry the greatest incidence and severity of injury per event compared with all other contact events, similar to previous findings in elite rugby (9). When expressed per 1000 player hours, the incidence of injuries resulting from collisions tackles was low relative to other contact events because of the low frequency of collision tackles in match play, but expressing the data per 1000 events highlights the relatively high-risk nature of collision tackles. Furthermore, although based on a small number of injuries (52 injuries from collision tackles), the number of matches missed per 1000 collision tackles is five times greater than that for other tackles. The ball carrier was at greater risk of injury than the collision tackler, which is similar to findings in elite rugby of a higher propensity for injury to the ball carrier but not the tackler in one-on-one collision tackles relative to general play (16). Since collision tackles are illegal in rugby union our data reinforce the importance of coaching correct technique, correcting player behaviour, and continued strict enforcement of penalising this offence. It is worthy of note that in February 2013 a global ban on the collision (shoulder) tackle was introduced in rugby league. Taking a zero tolerance approach to such incidents is likely to reduce injury risk.

The scrum is a phase of play that receives considerable attention from an injury perspective, with scrum collapse attracting particular interest. When all scrums are considered, the risk of injury per event is similar to the risk for rucks, mauls and lineouts, and is significantly lower than in the tackle. Our data show that in community level rugby ~6% of scrums result in collapse, compared with ~50% in international rugby (17). Although collapsed scrums are not a frequent occurrence in community rugby, preliminary data from one season shows a four-fold greater incidence and six-fold greater severity of injury per scrum as a result of collapsed scrums compared with scrums that did not collapse. Given that the scrum is ostensibly the most controllable contact event in rugby union, there should be continued focus on reducing scrum collapse.

We have previously reported a higher injury incidence in higher levels of English community rugby (7). Based on data from the current study, this can be attributed to a combined effect of both a higher frequency of contact events (group A, ~399; B, ~374, C, ~339 events per match) and a greater risk of injury per contact event (group A, ~0.8; B, ~0.6, C, ~0.6 injuries per 1000 events). However, the tackle is likely the main contributor to the overall higher incidence because it represents over half of all contact events at all levels and it is the only contact event with a significantly greater frequency (group A, ~157; B, ~139; C, ~126 tackles per match) and incidence rate per event (group A, ~1.5; B, ~1.1; C, ~1.1 injuries per 1000 tackles) in group A compared with B and C. Although the number of contact events per match is known, it is beyond the scope of the current study to determine what aspects of the tackle may cause injury and why the risk of injury is greater at higher playing levels. Entering the tackle at high speed is a risk factor for injury (16) and this could be exacerbated at higher playing levels if it assumed that players of a higher standard are physically fitter and faster. Recent evidence indicates that rugby league players who performed better in reactive agility tests (potentially indicative of their playing level) had a greater risk of contact injury, possibly due to being involved in more contact events (18), although further exploration of this concept is required. There is also a need to better understand the association between technique and injury risk as it is intuitive that better players display better tackle technique which is associated with lower injury risk (14). However, our findings indicate a higher risk of injury per event in higher level players. It has been shown that tackling proficiency might not be associated with injury risk in professional rugby league players (19), although it is likely that even those players who demonstrate proficiency in tackling drills experience lapses in tackle technique during match play which might be associated with injury events.

CONCLUSIONS

We show that initiatives to reduce the number of injuries sustained in contact events should focus on the tackle given that this event accounts for the highest incidence of injuries, most weeks absence and the second greatest risk of injury per event. It is unlikely that the number of contact events in community rugby match play will be reduced given the evolution of the game and therefore efforts to reduce injuries in contact events should focus on how events are carried out and managed by the players. Our findings also support vigilance in applying existing laws relating to collision tackles given the high risk of injury for these events. Furthermore, since scrums that collapse place players at significantly greater risk than scrums that do not collapse, any measure that reduces scrum collapse will likely reduce the number of injuries as a result of this phase of play.

What are the new findings?

- This study is the first to report propensity of specific contact events to cause injury in English community rugby union.
- Collision tackles (illegal tackles involving a shoulder charge) have a higher propensity for injury and weeks missed/1000 events than any other event.

- Only 5% of scrums in community rugby union collapse, but the propensity for injury is four times higher and the severity six times greater than for non-collapsed scrums.

How might it impact on clinical practice in the near future?

- A zero tolerance approach should be taken to illegal collision tackles to reduce injury risk.
- The scrum is a relatively controllable event and further attempts should be made to reduce the frequency of scrum collapse.
- Club medical and coaching staff can use these data to better understand the extent of the injury problem in community rugby.

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Tables:

Table 1. Number of contacts events per match, injury incidence and number of injuries per 1000 contacts events for all groups combined.

	Events per match	Injuries per 1000 players hours	Injuries per 1000 events
All events	370.1 (363.8-377.6)	13.2 (12.5-14.0)	1.2 (1.2-1.3)
All tackles	140.9 (136.7-145.2)	8.4 (7.8-9.0)[a]	2.3 (2.2-2.4)[d,e,f,g]
Tackled	-	*4.8 (4.3-5.2)[b,c,d,e,f,,h,i]*	*1.3 (1.2-1.4)[b,d,e,f,g]*
Tackling	-	*3.6 (3.2-4.0)[c,d,e,f,g,h,i]*	*1.0 (0.9-1.1)[d,e,f,g]*
Collision tackle	1.4 (1.1-1.9)	0.6 (0.4-0.6)[g]	15.0 (12.4-18.3)[a]
Coll tackled	-	*0.5 (0.3-0.6)[i]*	*12.7 (10.3-15.7)[b,d,e,f,g,i,j]*
Coll tackling	-	*0.1 (0.0-0.1)*	*2.3 (1.4-3.8) [b,d,e,f,,i,j]*
Ruck	115.0 (111.2-118.9)	1.6 (1.3-1.8)[c,e,f,g,h,i]	0.5 (0.5-0.6)
Maul	23.4 (21.7-25.2)	0.5 (0.3-0.6)[i]	0.7 (0.6-0.9)[d,g]
Scrum	32.2 (30.2-34.3)	0.6 (0.5-0.8)[g]	0.7 (0.6-0.9)[d,g]
Lineout	25.6 (23.9-27.5)	0.3 (0.2-0.5)[i]	0.5 (0.4-0.6)

[a]Significantly higher rate compared with all other events; [b]higher than tackling; [c]higher than collision tackle; [d]higher than ruck; [e]higher than maul; [f]higher than scrum; [g]higher than lineout; [h]higher than collision tackled; [i]higher than collision tackling; [j]higher than tackled

Table 2. Mean severity of contact events, number of weeks missed per 1000 player hours and per 1000 events.

	Severity		
	Mean weeks missed	Weeks missed per 1000 player hours	Weeks missed per 1000 events
All events	7.7	91.6 (86.4 -97.2)	9.5 (9.1-9.9)
Tackle	8.1	68.0 (63.4-73.0)[a]	18.6 (17.6-19.5)[e,f,g,h]
Tackled	*8.4*	*40.3 (36.7-44.3)*[b,c,d,e,f,g]	*10.9 (10.2-11.7)*[c,d,e,f,g]
Tackling	*7.8*	*28.1 (25.2-31.2)*[b,d,e,f,g]	*7.7 (7.2*-8.3)[e,f,g,h]
Collision tackle	7.1	4.3 (3.3-5.6)[f]	108.8 (89.5-132.1)[a]
Coll tackled	*6.3*	*3.2 (2.4-4.2)*	*81.9 (66.4-101.2)*[c,d,ef,g,h,i]
Coll tackling	*12.4*	*1.2 (0.6-2.5)*	*28.7 (17.4-47.4)*[c,d,e,f,g,h]
Ruck	6.3	9.9 (8.4-11.6)[c,f,g,h]	3.3 (2.9-3.7)
Maul	8.8	4.4 (3.3-6.0)	6.6 (5.3-8.2)[e,f]
Scrum	7.3	4.9 (3.8-6.3)[f,h]	5.4 (4.4-6.5)[e,f]
Lineout	9.3	2.9 (2.0-4.2)	4.4 (3.4-5.7)

[a]higher than all other events; [b]higher than collision tackle; [c]higher than tackling; [d]higher than ruck; [e]higher than lineout; [f]higher than scrum; [g]higher than maul; [h]higher than tackled; [i]higher than collision tackling

Table 3. Number of scrums per match, injury incidence and number of injuries per 1000 contacts events for all groups combined (data for season 2011/12 only).

		Incidence	Propensity
	Events per match	Injuries per 1000 players hours	Injuries per 1000 events
All scrum	32.2 (30.2-34.3)	0.6 (0.4-0.9)	0.7 (0.6-1.0)
Collapsed scrum	1.8 (1.4-2.4)	0.1 (0.1-0.3)	2.9 (1.5-5.4)*
Scrum (non-collapse)	30.4 (28.5-32.4)	0.4 (0.3-0.8)	0.6 (0.4-0.9)

*Significantly higher rate compared with scrums (non-collapse).

Table 4. Mean severity of scrum injuries with number of weeks missed per 1000 player hours and per 1000 events for all groups combined.

	Severity		
	Mean weeks missed	Weeks missed per 1000 player hours	Weeks missed per 1000 events
All scrum	5.8	3.6 (2.4-5.4)	4.3 (3.2-5.7)
Collapsed scrum	7.7	1.0 (0.4-2.5)	22.0 (11.7-41.5)*
Scrum (non-collapse)	5.6	3.7 (2.4-5.9)	3.4 (2.4-4.8)

*Significantly higher rate compared with scrums (non-collapse).

Figures:

Figure 1. The incidence of injuries within each body region as a result of tackling and being tackled. *Significantly higher incidence compared with tackling ($P < 0.001$). #Significantly higher incidence compared with tackled ($P < 0.001$).